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STATIC FORCE TESTS OF THE AEDC-VKF STANDARD 5 DEGREE CONE IN TU--ETC(U)
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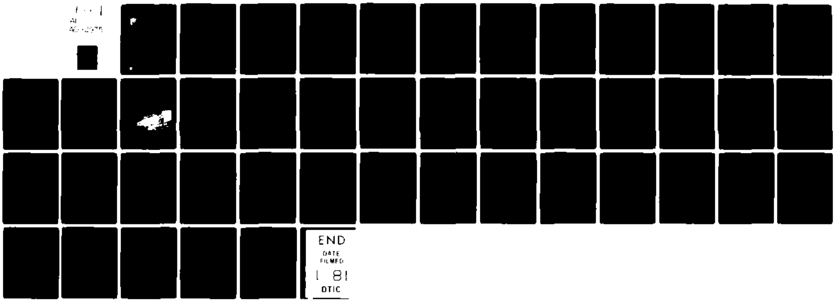

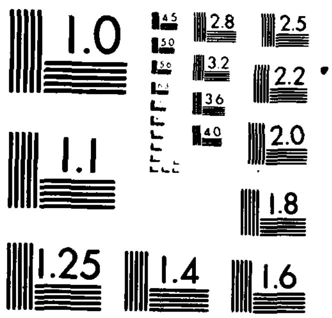

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NATIONAL BUREAU OF STANDARDS-1963 A

AEDC-TSR-79-V51

STATIC FORCE TESTS OF THE AEDC-VKF STANDARD 5 DEGREE CONE IN TUNNEL A AT MACH NUMBERS 1.5 TO 4.0

J. T. Best
ARO, Inc.

September 1979

Final Report for Period April 30 to August 1, 1979

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ARNOLD ENGINEERING DEVELOPMENT CENTER
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This report has been reviewed and approved.

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Approved for publication:

FOR THE COMMANDER

James D Sanders

JAMES D. SANDERS, Colonel, USAF
Director of Test Operations
Deputy for Operations

9 Final rept. 30 Apr 1-1 Aug 79

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REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER
14 AEDC-TSR-79-V51

2. GOVT ACCESSION NO.
AD-A092975

3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle)
6 Static Force Tests of the AEDC-VKF Standard 5 Degree Cone in Tunnel A at Mach Numbers 1.5 to 4.0.

5. TYPE OF REPORT & PERIOD COVERED
Final Report,
April 30 to August 1, 1979

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)
10 J. T./Best ARO, Inc., a Sverdrup Corporation Company

8. CONTRACT OR GRANT NUMBER(s)
12 45

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Arnold Engineering Development Center/DOOV
Air Force Systems Command
Arnold Air Force Station, TN 37389

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
Program Element 65807F

11. CONTROLLING OFFICE NAME AND ADDRESS
Arnold Engineering Development Center/DOS
Air Force Systems Command
Arnold Air Force Station, TN 37389

12. REPORT DATE
11 Sep[redacted]79

13. NUMBER OF PAGES
41

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)

15. SECURITY CLASS. (of this report)
UNCLASSIFIED

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
N/A

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Available in Defense Technical Information Center (DTIC)

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

aerodynamic forces
standard 5 deg cone
base pressures
supersonic flow
boundary layer trips
Reynolds number

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Static stability and base pressure tests were conducted on ~~the Arnold Engineering~~ Development Center (AEDC) von Kármán Gas Dynamics Facility (VKF) standard force cone. The tests were performed at nominal Mach numbers of 4.0, 3.75, 3.25, 3.0, 2.75, 2.5, 2.25, 2.0, 1.75, 1.63, and 1.5 at free-stream unit Reynolds numbers ranging from 0.6 x 10^6 per foot to 3.7 x 10^6 per foot. The angle-of-attack and angle-of-sideslip ranges were from -11 to 11 deg. Configuration variables were nose bluntness and fins. The effects on static force

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20. ABSTRACT (Continued)

data of the following were obtained: tunnel-nozzle jack setting errors, tunnel-flow humidity, and tunnel-sidewall misalignment.

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CONTENTS

APPENDIXES

NOMENCLATURE

A	Reference area, 28.274 in.^{2}
AB	Base area, 28.274 in.^{2}
A.C.	Aerodynamic center location, body axes, inches from model nose, XMRP-(CLM-A · L/CN-A)
A.C.P	Aerodynamic center location, missile axes, inches from model nose, XMRP-(CLMP-A · L/CNP-A)
ALPHA	Angle of attack, deg
ALPI	Indicated sector pitch angle, deg
ALPP	Total angle of attack, missile axes, deg
BETA	Sideslip angle, deg
CA	Forebody axial-force coefficient, body axes, CAT-CAB
CAB	Base axial-force coefficient, body axes, -AB(PBA-P)/Q · A
CAP	Forebody axial-force coefficient, missile axes
CAT	Total axial-force coefficient, body axes, total axial force/Q · A
CLL	Rolling-moment coefficient, body axes, rolling moment/Q · A · L
CLLP	Rolling-moment coefficient, missile axes
CLM	Forebody pitching-moment coefficient, body axes, pitching-moment/Q · A · L
CLM-A	Slope of CLM versus ALPHA curve, deg^{-1}
CLMO	Value of CLM at CN = 0
CLMP	Forebody pitching-moment coefficient, missile axes
CLMPO	Value of CLMP at CNP = 0
CLMP-A	Slope of CLMP versus ALPP curve, deg^{-1}

CLN	Yawing-moment coefficient, body axes, yawing-moment, Q · A · L
CLNO	Value of CLN at CY = 0
CLNP	Yawing-moment coefficient, missile axes
CLNPO	Value of CLNP at CYP = 0
CN	Normal-force coefficient, body axes, normal force/Q · A
CN-A	Slope of CN versus ALPHA curve, deg^{-1}
CNP	Normal-force coefficient, missile axes
CNP-A	Slope of CNP versus ALPP curve, deg^{-1}
CODE	Model configuration number
CONFIG	Model configuration designation
CY	Side-force coefficient, body axes, side force/Q · A
CYP	Side-force coefficient, missile axes
L	Reference length, 34.29 in.
LM	Model length, 34.29 in.
M	Free-stream Mach number
NCP	Normal-force center-of-pressure location, body axes, inches from model nose, XMRP - (CLM - CLMO) · L/CN
NCPP	Normal-force center-of-pressure location, missile axes, inches from model nose, XMRP - (CLMP-CLMPO) · L/CNP
P	Free-stream static pressure, psia
PBA	Average base pressure, psia
PBD	Fast response base pressure, psia
PB1-PB4	Base pressure, psia
PHI	Roll angle, deg
PHII	Indicated roll angle, deg
PN	Data point number
PT	Tunnel stilling chamber pressure, psia

Q	Free-stream dynamic pressure, psia
RB	Model base radius, 3.00 in.
RE	Free-stream unit Reynolds number, ft^{-1}
RN	Model nose radius, in.
RUN	Data set identification number
T	Free-stream static temperature, ^{o}R
TDPC	Dew point temperature as measured by Cambridge Instrument, ^{o}F
TDPD	Dew point temperature as measured by Dupont Instrument, ^{o}F
TT	Tunnel stilling chamber temperature, ^{o}R
TXL	Tunnel axial location of model nose (see Fig. 4), in.
XMRP	Distance from model moment reference point to model nose, in.
YCP	Side-force center-of-pressure location, body axes, inches from model nose, XMRP - (CLN -CLNO) · L/CY
YCPP	Side-force center-of-pressure location, missile axes, inches from model nose, XMRP - (CLNP -CLNPO) · L/CYP

1.0 INTRODUCTION

The work reported herein was conducted by the Arnold Engineering Development Center (AEDC), Air Force Systems Command (AFSC), under Program Element 65807F, Control Number 9T03-00-9. The results were obtained by ARO, Inc., AEDC Group (a Sverdrup Corporation Company), operating contractor for the AEDC, AFSC, Arnold Air Force Station, Tennessee. The test was conducted in the von Kármán Gas Dynamics Facility (VKF), Tunnel A during the period of April 30, 1979 through August 1, 1979 under ARO Project No. V41A-07.

One objective of this test was to provide data for the "high quality" data bank of the VKF standard 5-deg cone in Tunnels A, B, and C. The standard cone model (and data bank) will be used for defining test section flow nonuniformity effects and evaluating the performance of the total system (balance-support hardware, model dynamics, data acquisition systems, data reduction techniques, etc.) on a routine and systematic basis using "selected" test installations. Table 1 shows the proposed data bank with the data obtained in previous tests* and also including the results of this test. Another objective of the test was to determine the effects on static force data of the following: tunnel-nozzle jack setting errors, tunnel-flow humidity, and tunnel-sidewall misalignment.

The test was conducted in two phases: The finless configurations were tested in Phase I, and the finned configurations in Phase II.

Static stability, axial force, and base pressure data were obtained at $M_\infty = 1.5$ through 4.0 in Tunnel A for Reynolds numbers from 0.6 x 10^6/ft to 3.7 x 10^6/ft. The angle-of-attack and angle-of-sideslip range was -11 to 11 deg and the roll angle ranged from -180 deg to 180 deg. Model flow-field photographs were obtained on all configurations at selected model attitudes and test conditions.

Inquiries to obtain copies of the test data should be directed to AEDC/DOOV, Arnold Air Force Station, Tennessee 37389. A microfilm record has been retained in the VKF at AEDC.

2.0 APPARATUS

2.1 TEST FACILITY

Tunnel A (Fig. 1) is a continuous, closed-circuit, variable density wind tunnel with an automatically driven flexible-plate-type nozzle and a 40- by 40-in. test section. The tunnel can be operated at Mach numbers from 1.5 to 6 at maximum stagnation pressures from 29 to 200 psia, respectively, and stagnation temperatures up to 750°R at Mach number 6. Minimum operating pressures range from about one-tenth to one-twentieth of the maximum at each Mach number. The tunnel is equipped with a model injection system that allows removal of the model from the test section

*Jenke, Leroy M. "Static Force Tests of the AEDC-VKF Standard 5-Deg Cone in Tunnels A (M_∞ = 3.0 to 5.5) and B (M_∞ = 6)." AEDC-TSR-78-V20, August 1978.

while the tunnel remains in operation. A description of the tunnel and airflow calibration information may be found in the Test Facilities Handbook*.

2.2 TEST ARTICLE

The standard cone model (Fig. 2) is a 5-deg, half-angle cone with a 6-in. base diameter fabricated from stainless steel. There are two basic interchangeable nose sections: sharp (0.002-in. spherical radius), and 12.5 percent blunt ($R_N/R_B = 0.125$). The virtual length of the sharp cone is 34.290 inches and the model wall thickness is typically 0.25 in. Boundary layer trips (Fig. 3) were used to ensure a fully turbulent boundary layer over most of the model surface. These trips were machined on the sharp nose configurations and consisted of grit applied on the blunt nose configurations. A cylindrical section with four rectangular fins was also provided (Fig. 2). A wide range of balance adapters exist to fit the model to most VKF balances (normal load range from 80 to 1000 lbs). The model components designation is presented in Table 2. The model installations in the tunnel for Phase I and Phase II are shown in Figure 4.

2.3 TEST INSTRUMENTATION

The measuring devices, recording devices, and calibration methods used for all measured parameters are listed in Table 3 along with the estimated measurement uncertainties. The fast-response base pressure measurement (PBD) taken during continuous-sweep runs was made with a low-volume transducer. This transducer was used to measure the base pressure trend from a static value obtained by averaging PB1-PB4.

3.0 TEST DESCRIPTION

3.1 TEST CONDITIONS AND PROCEDURES

3.1.1 General

A summary of the nominal test conditions at each Mach number is given below.

M	PT, psia	TT, °R	Q, psia	P, psia	RE x 10^{-6}/ft
4.0	46.9	600	3.46	0.31	3.7
3.75	41.2	600	3.75	0.38	↓
3.25	30.2	580	4.20	0.57	↓
3.0	26.4	↓	4.53	0.72	↓
3.0	11.4	↓	1.96	0.31	1.6
2.75	23.2	↓	4.89	0.93	3.7
2.5	20.3	↓	5.20	1.19	↓
2.5	8.8	↓	2.25	0.52	1.6
2.25	17.9	↓	5.49	1.55	3.7
2.0	14.6	545	5.23	1.87	↓
2.0	13.8	↓	4.94	1.76	3.5
2.0	6.3	↓	2.25	0.81	1.6
1.75	13.2	↓	5.32	2.48	3.7
1.62	12.7	↓	5.33	2.90	↓
1.5	12.3	↓	5.28	3.35	↓
1.5	5.3	↓	2.27	1.44	1.6

*Test Facilities Handbook (Eleventh Edition). "von Kármán Gas Dynamics Facility Vol. 3" Arnold Engineering Development Center, June 1979.

At some test conditions, particularly at subatmospheric stagnation pressures, the humidity level of the tunnel flow affects the test section Mach number. The Tunnel A sidewall Mach number probe is used periodically when testing at these conditions to monitor deviations from the standard calibrated Mach numbers. When a deviation is measured, the free-stream conditions are corrected and the actual Mach number is printed on the data tabulations.

A test summary showing all configurations tested and the variables for each is presented in Table 4.

In the VKF continuous-flow wind tunnels (A, B, C), the model is mounted on a sting support mechanism in an installation tank directly underneath the tunnel test section. The tank is separated from the tunnel by a pair of fairing doors and a safety door. When closed, the fairing doors, except for a slot for the pitch sector, cover the opening to the tank and the safety door seals the tunnel from the tank area. After the model is prepared for a data run, the personnel access door to the installation tank is closed, the tank is vented to the tunnel flow, the safety and fairing doors are opened, the model is injected into the airstream, and the fairing doors are closed. After the data are obtained, the model is retracted into the tank and the sequence is reversed with the tank vented to atmosphere to allow access to the model in preparation for the next run. The sequence is repeated for each configuration change.

Model attitude positioning and data recording were accomplished with the point-pause and sweep modes of operation, using the VKF Model Attitude Control System (MACS). Model pitch and yaw requirements were entered into the controlling computer prior to the test. Model positioning and data recording operations were performed automatically during the test by selecting the list of desired model attitudes and initiating the system.

The effects on static force data of tunnel-nozzle jack setting errors, tunnel-flow humidity and tunnel-sidewall misalignment were studied as follows. Tunnel-nozzle jack setting errors were simulated by driving specific jacks off their nulled position 0.050 or 0.075 inches toward the tunnel centerline. The test summary, Table 4, denotes which jacks were driven and the amount. Figure 5 shows a view of the Tunnel A nozzle with the identification and location of the nozzle jacks. Tunnel-flow humidity effects were obtained by opening atmospheric intake valve (007) and bypassing the driers normally in the tunnel circuit. Data were obtained periodically as the dew point temperature increased. The effects of tunnel-sidewall misalignment were simulated by placing a strip of aluminum tape 0.005 inches thick on the non-operating sidewall from the top to the bottom of the tunnel. A 0.010-inch step was simulated by using two strips of tape. The location of the leading edge of the tape is shown in Fig. 4b.

3.1.2 Data Acquisition

Data were recorded in either the point-pause or sweep mode of operation, using the MACS. The mode for each data group is identified in the test summary (Table 4).

The point-pause data were obtained for finite values of ALPHA, PHI, and/or BETA with a delay before each data point to allow the base pressures to stabilize. Each data point for this mode of operation represents the resultant of a Kaiser-Bessel digital filter utilizing 16 samples taken over a time span of 0.0208 sec. For the retract data, a data point was automatically taken every 2 seconds as the model was retracted from the tunnel to obtain a data point approximately every inch in TXL.

The continuous-sweep data were obtained for a fixed value of PHI with a sweep (ALPHA) rate of 0.5 deg/sec or a fixed value of ALPHA with a roll (PHI) rate of 3.0 deg/sec. A data sample was recorded every 0.0208 sec, and 16 samples were applied to a Kaiser-Bessel digital filter to produce a data point every 0.156 and 0.936 deg in pitch and roll, respectively. The data were then interpolated to obtain the data at the desired model attitudes.

3.2 DATA REDUCTION

The cone static force data were obtained by utilizing the tunnel data acquisition system as described in Section 3.1.2. The force and moment measurements were reduced to coefficient form by using the digitally filtered data points and correcting the first- and second-order balance interaction effects. The coefficients were also corrected for model tare weight and balance-sting deflections. Model attitude, tunnel stilling chamber pressure, and fast-response base pressure were also calculated from digitally filtered values.

The aerodynamic force and moment coefficients are presented in the body and nonrolling body (missile) axis systems. For the missile axis system, the normal-force direction is always in the pitch plane of the tunnel and normal to the longitudinal axis of the model. In the body axis system, the pitching and yawing moment coefficients are referenced to two points on the model centerline which were (1/2) LM and (2/3) LM from the model nose. The missile axis data were calculated from the body axis data referenced to the (2/3) LM moment reference point. Model length (34.290 in.) and base area (28.274 in.^{2}) were used as the reference length and area for the aerodynamic coefficients.

For selected runs, the body-axis data which were referenced to the (2/3) LM moment reference point were corrected for small tunnel-flow nonuniformities. The corrected data were then used to evaluate center of pressure locations. Those runs whose data were corrected are identified in the Test Summary, Table 4.

3.3 UNCERTAINTY OF MEASUREMENTS

In general, instrumentation calibrations and data uncertainty estimates were made by using methods recognized by the National Bureau of Standards (NBS).* Measurement uncertainty is a combination of bias and precision errors defined as:

$$U = \pm(B + t_{95}S)$$

where B is the bias limit, S is the sample standard deviation, and t_{95} is the 95th percentile point for the two-tailed Student's "t" distribution, (95-percent confidence interval) which for sample sizes greater than 30 is taken equal to 2.

Estimates of the measured data uncertainties for this test are given in Table 3a. With the exception of the force and moment balance, data uncertainties are determined from in-place calibrations through the data recording system and data reduction program. Static load hangings on the balance simulate the range of loads and center-of-pressure locations anticipated during the test, and measurement errors are based on differences between applied loads and corresponding values calculated from the balance equations used in the data reduction. Load hangings to verify the balance calibration are made in-place on the assembled model.

Propagation of the bias and precision errors of measured data through the calculated data was made in accordance with the reference noted below, and the results are given in Table 3b.

4.0 DATA PACKAGE PRESENTATION

The data package contains tabulated model aerodynamic force and moment data presented in the body and missile axis systems. Sample tabulations of the data found in the data package are given in Appendix III.

The body axis data about the (2/3) LM moment reference point are presented twice for some runs. These data are presented both corrected and uncorrected for tunnel-flow nonuniformities. For the runs in which tunnel-flow humidity effects were being studied, these data are presented both corrected and uncorrected for the tunnel-flow humidity effects on M and PT. The corrected data for these cases are marked accordingly.

One copy of the data package was given to AEDC/DOOV, Arnold AFS, Tennessee 37389. A microfilm copy was retained in the VKF at AEDC. Copies of the photographic data and installation/configuration photographs were also retained at the VKF.

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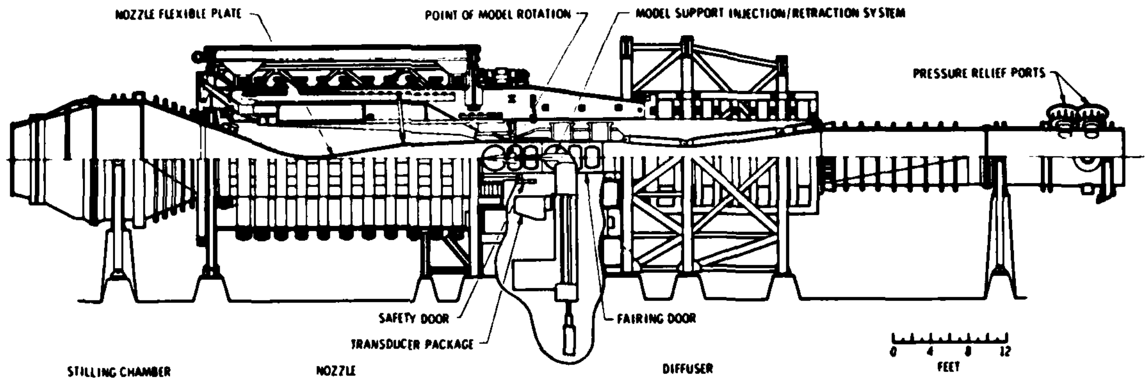
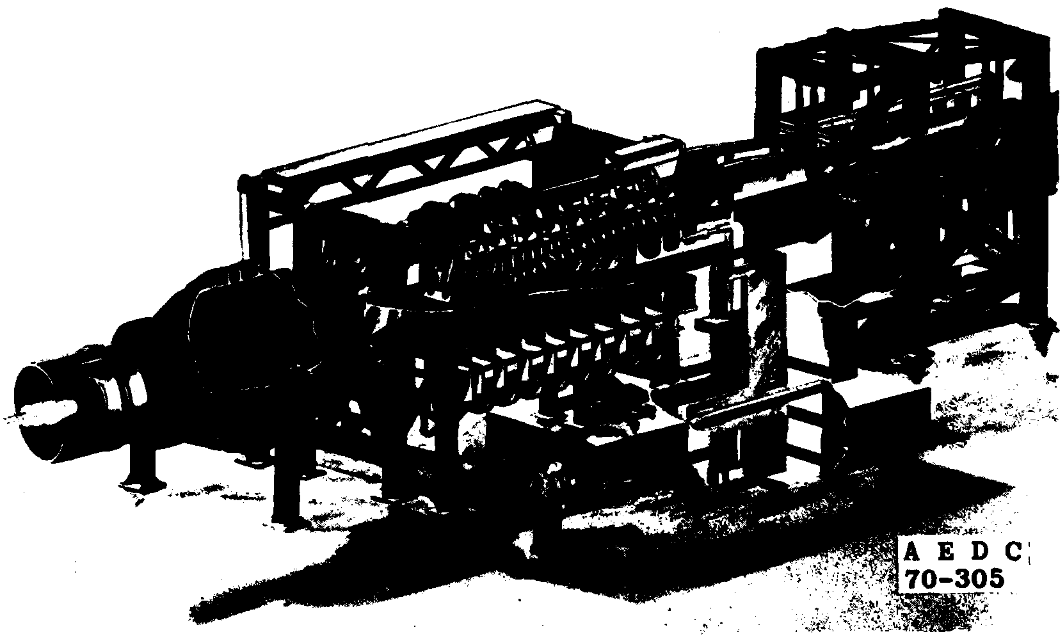
*Thompson, J. W. and Abernethy, R. B. et al. "Handbook Uncertainty in Gas Turbine Measurements." AEDC-TR-73-5 (AD755356), February 1973.

APPENDIX I

ILLUSTRATIONS

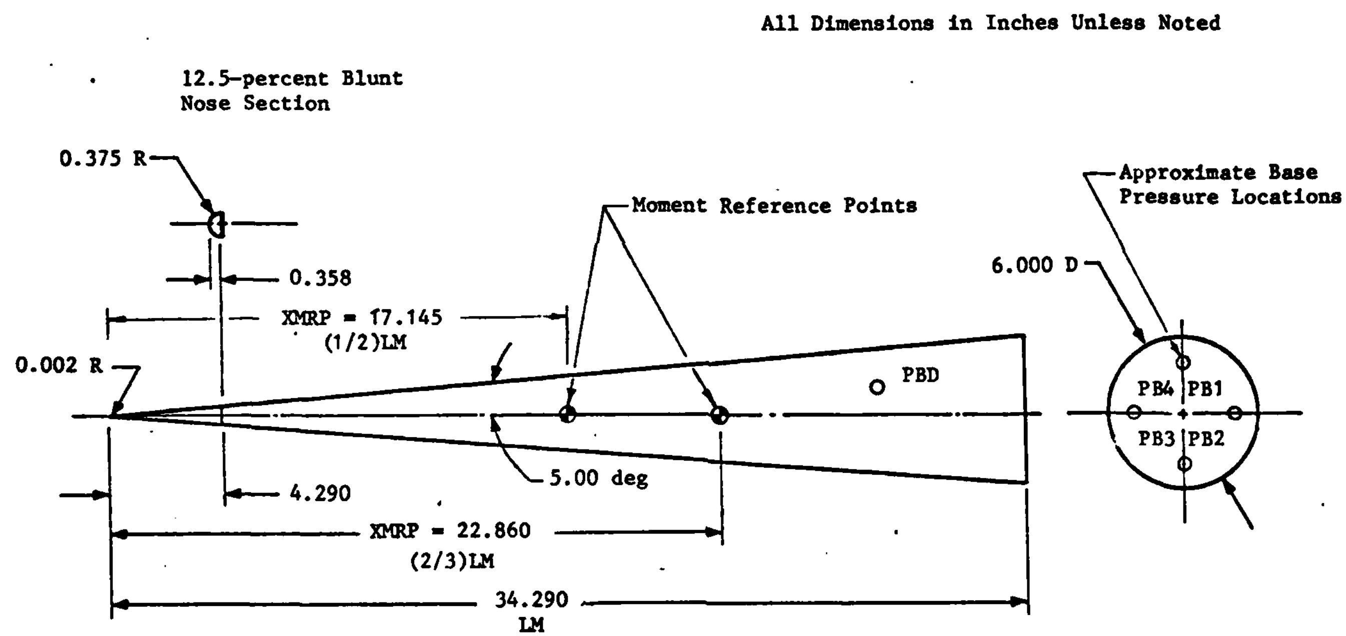


a. Tunnel assembly



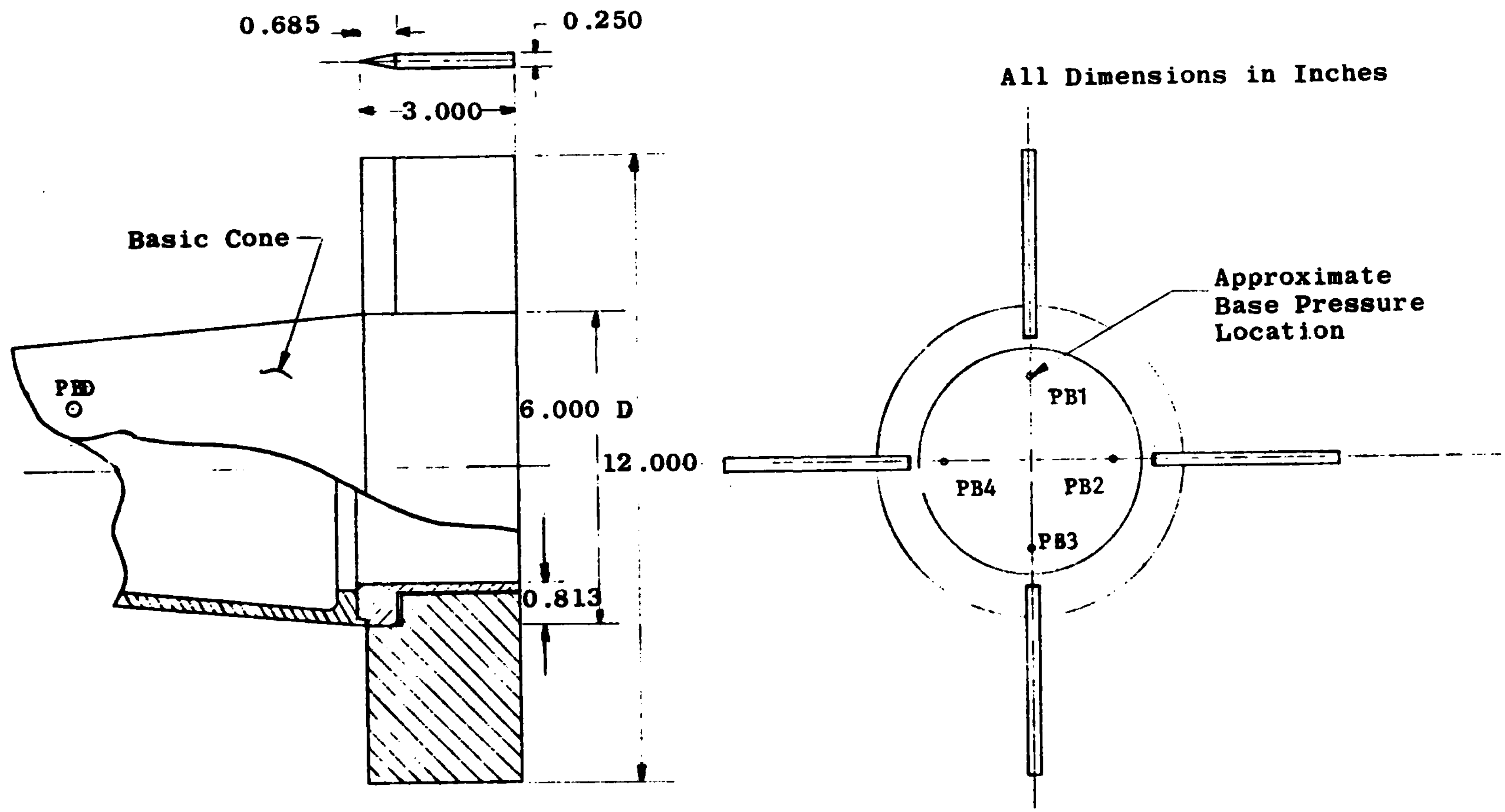
b. Tunnel test section

Fig. 1 Tunnel A



a. Model External Geometry (Basic Cone)

Fig. 2 Model Details

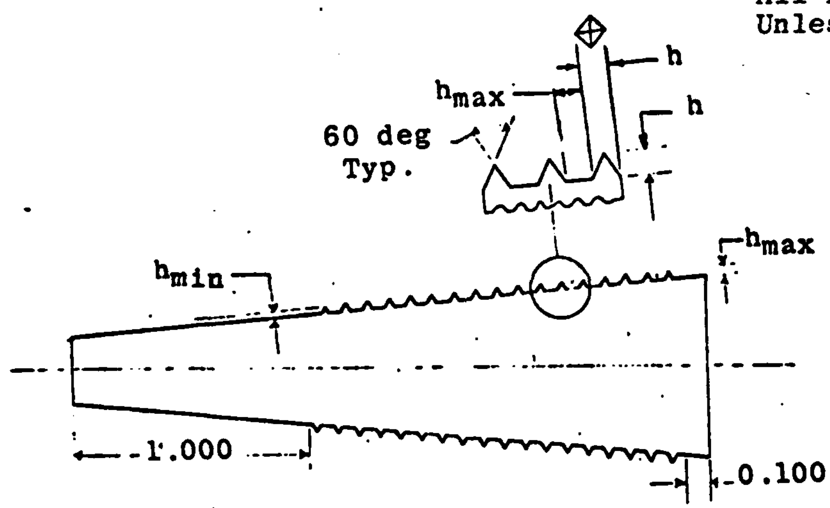


b. Fin Extension

Fig. 2 Concluded

Trips are not drawn to scale.

All Dimensions in Inches
Unless Noted

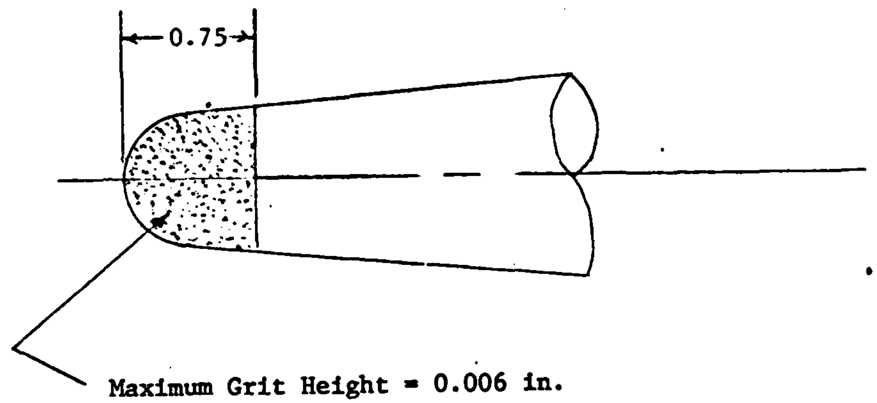


h_{max}	h_{min}	Number of Pyramids around the Circumference
0.030	0.019	33

a. Trips for sharp nose configurations, T30C

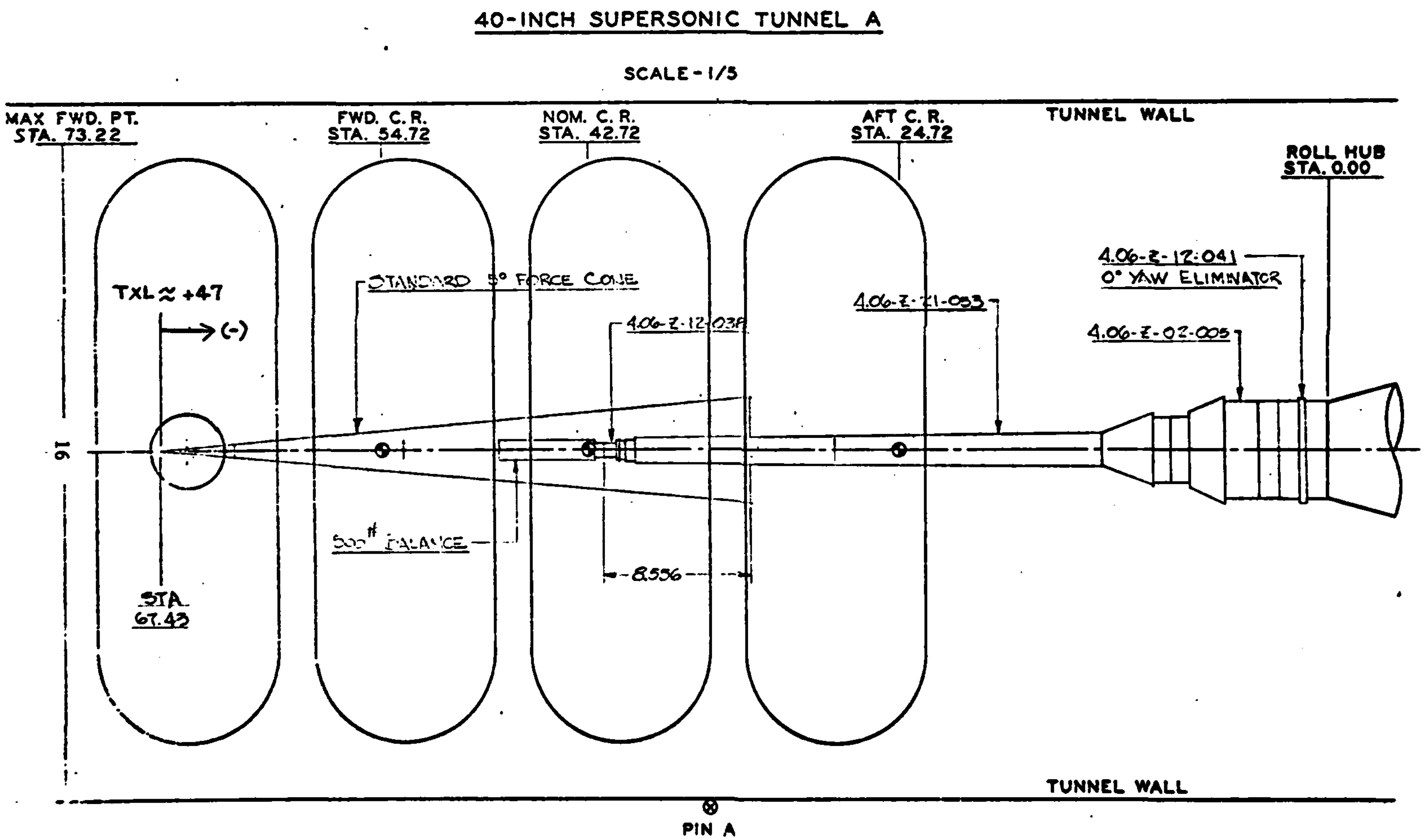
Fig. 3 Boundary Layer Trip Details

All Dimensions in Inches



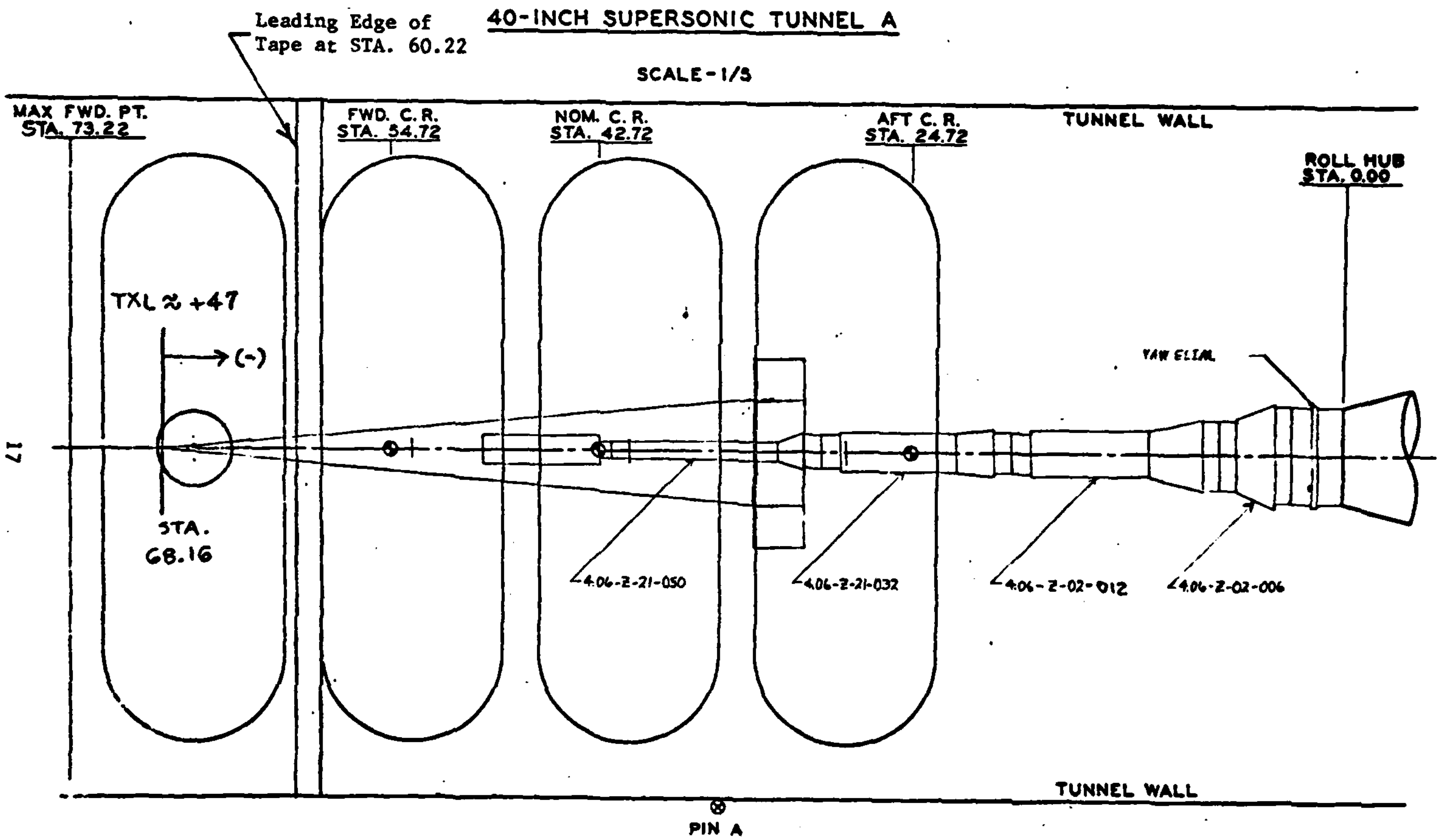
b. Trip for blunt nose configuration, T06R

Fig. 3 Concluded



a. Phase I

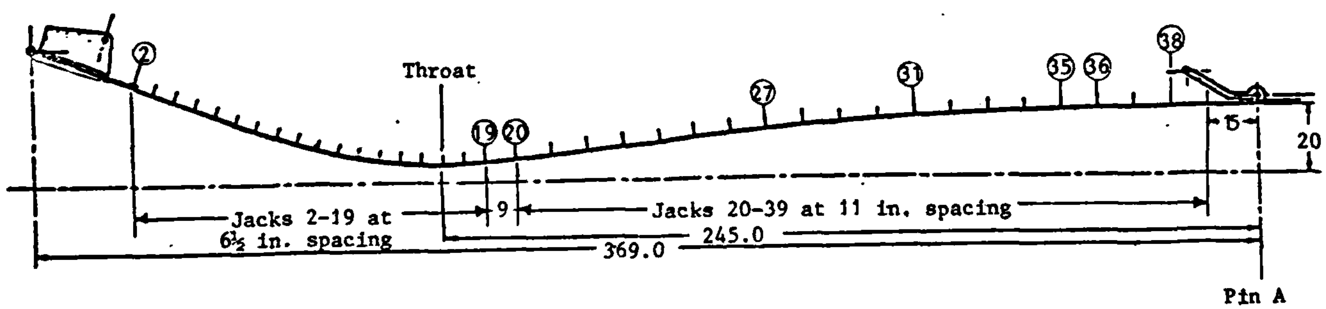
Fig. 4 Installation Sketches



b. Phase II

Fig. 4 Concluded

All Dimensions in Inches



Only Top Plate Shown

Bottom Plate Jack Locations are Identical to Top

Bottom Plate Jack Identification is Top + 40 (e.g., 19 on Top, 59 on Bottom)

Fig. 5 Tunnel A Nozzle Jack Identification and Location

APPENDIX II

TABLES

TABLE I

Standard 5-Deg Cone Data Bank Summary (Tunnels A/B/C)

Wind Tunnel		A															B		C
Config.	M / RE x10^6/ft	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.50	5.00	5.50	6.00	6.00	8.00	10.00
Sharp	0 to 1							x								o	x	o	o
	1 to 2	x		x		o		x		x		o	o	o	o		o	o	x
	2 to 3															o	x		o
	3 to 4*	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	
	4 to 5																x		
	5 to 7	o		o		o		o		o		o							
	7 to 9																		
Blunt	0 to 1															o	x	x	x
	1 to 2	x		x		x		x		o		o	o	o	o		o	x	x
	2 to 3															o			o
	3 to 4*	x	x	x	x	x	o	x	x	x	x	x	x	x	x		x	x	
	4 to 5																x		
	5 to 7	o		o		o		o		o		o							
	7 to 9																		

* Primary Reynolds Number = 3.7×10^6/ft

o Planned

x Accomplished

TABLE 2

MODEL CONFIGURATION DESIGNATION

Nose Designation (NXX.X)

N00.0	sharp nose
N12.5	spherically blunted nose(RN/RB = 0.125)

Boundary-Layer Trip Designation (TXXX)

T30C	machined trips, h_{max} = 0.030 in.
T06R	grit trips, h_{max} = 0.006 in.

Fin Designation (FX)

F0	no fins or body extension
F2	two fins (horizontal plane)
F4	four fins

Base Plate Designation (BX)

B0	no base plate

TABLE 3. ESTIMATED UNCERTAINTIES

a. Basic Measurements

Parameter Designation	Steady-State Estimated Measurement*: Precision Index (S), Percent of Reading	Precision Index (S), Unit of Measurement	Precision Index (S), Degree of Freedom	Bias (B), Percent of Reading	Bias (B), Unit of Measurement	Uncertainty ±(B + $t_{95}S$), Percent of Reading	Uncertainty ±(B + $t_{95}S$), Unit of Measurement	Range	Type of Measuring Device	Type of Recording Device	Method of System Calibration
PT,psia		±0.002	>30		±0.011		±0.015	0 to 5.5	Bell and Howell Variable Capacitance Transducer	Digital Data Acquisition System Analog to Digital Converter	In Place Air Dead Weight Calibration
		±0.002	>30	±0.2		±(0.2%+0.004)		5.5 to 15			
		±0.007	>30	±0.2		±(0.2%+0.014)		15 to 60			
TT,°F		±1.5	>30		0+		±3	0 to 300	Copper-Constantan Thermocouple	Doric Temperature Instrument/Digital Multiplexer	Thermocouple Verification of NBS Conformity/Voltage Substitution Calibration
ALPI,deg		±0.025	>30		0+		±0.05	±15	Potentiometer	Digital Data Acquisition System Analog to Digital Converter →	Precision Inclinometer Gage Reading
PHII,deg		±0.075	>30		0+		±0.15	±180			
Normal Force, lb		±0.253	>30		±0.082		±0.588	±500	Six-Component Strain Gage Balance 4.01-Y-36-043		Static Loading →
Pitching Moment,in.-lb		±1.350	>30		±0.519		±3.219	±1850			
Side Force, lb		±0.368	>30		±0.110		±0.846	±250			
Yawing Moment, in.-lb		±1.826	>30		±0.477		±4.129	±925			
Rolling Moment,in.-lb		±0.062	>30		±0.012		±0.136	±100			
Axial Force, lb		±0.151	>30		±0.007		±0.309	0 to 300			
Fast Response Base Pressure, psia	±0.04		>30		0+	±0.08		±15	Druck(Variable Resistance)Transducer		In Place Air Dead Weight Calibration →
PB1-PB4,psia		±0.0015	>30		0+		±0.003	0 to 2	Bell and Howell Variable Capacitance Transducer		
	±0.075		>30		0+	±0.15		2 to 15			
Longitudinal Moment Transfer Distance, in		±0.0025	>30		0+		±0.005		Precision Height Gage and Micrometers	—	Calibrated in the Standards Laboratory

*Thompson, J. W. and Abernethy, R. B. et al. "Handbook Uncertainty in Gas Turbine Measurements." AEDC-TR-73-5 (AD 755356), February 1973.

+ Assumed to be zero.

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TABLE 3. Continued

b. Calculated Parameters

Parameter Designation	Steady-State Estimated Measurement* — Precision Index (S): Percent of Reading	Precision Index (S): Unit of Measurement	Precision Index (S): Degree of Freedom	Bias (B): Percent of Reading	Bias (B): Unit of Measurement	Uncertainty $\pm(B + t_{95}S)$: Percent of Reading	Uncertainty $\pm(B + t_{95}S)$: Unit of Measurement	$M/RE \times 10^{-6}$	Type of Measuring Device	Type of Recording Device	Method of System Calibration
CN		0.0047			0.0013		0.0107	4.0/3.7			
		0.0051			0.0013		0.0115	3.75/3.7			
		0.0062			0.0013		0.0137	3.25/3.7			
		0.0059			0.0017		0.0135	3.0/3.7			
		0.0059			0.0018		0.0136	3.0/1.6			
		0.0037			0.0012		0.0086	2.75/3.7			
		0.0029			0.0012		0.0070	2.5/3.7			
		0.0046			0.0016		0.0108	2.5/1.6			
		0.0029			0.0011		0.0069	2.25/3.7			
		0.0027			0.0011		0.0065	2.0/3.7			
		0.0042			0.0018		0.0102	2.0/3.5			
		0.0045			0.0016		0.0106	2.0/1.6			
		0.0021			0.0011		0.0053	1.75/3.7			
		0.0020			0.0008		0.0048	1.62/3.7			
		0.0018			0.0011		0.0047	1.5/3.7			
		0.0040			0.0016		0.0096	1.5/1.6			
CLM		0.0004			0.0002		0.0010	4.0/3.7			
		0.0004			0.0002		0.0010	3.75/3.7			
		0.0004			0.0001		0.0009	3.25/3.7			
		0.0010			0.0003		0.0023	3.0/3.7			
		0.0008			0.0003		0.0019	3.0/1.6			
		0.0003			0.0001		0.0007	2.75/3.7			
		0.0003			0.0001		0.0007	2.5/3.7			
		0.0007			0.0002		0.0016	2.5/1.6			
		0.0003			0.0001		0.0007	2.25/3.7			
		0.0003			0.0001		0.0007	2.0/3.7			
		0.0008			0.0004		0.0020	2.0/3.5			
		0.0007			0.0003		0.0017	2.0/1.6			
		0.0003			0.0001		0.0007	1.75/3.7			
		0.0003			0.0001		0.0007	1.62/3.7			
		0.0003			0.0001		0.0007	1.5/3.7			
		0.0007			0.0002		0.0016	1.5/1.6			
CY		0.0038			0.0011		0.0087	4.0/3.7			
		0.0035			0.0010		0.0080	3.75/3.7			
		0.0031			0.0009		0.0071	3.25/3.7			
		0.0029			0.0009		0.0067	3.0/3.7			
		0.0067			0.0020		0.0154	3.0/1.6			
		0.0027			0.0008		0.0062	2.75/3.7			
		0.0034			0.0013		0.0081	2.5/3.7			
		0.0058			0.0017		0.0133	2.5/1.6			

*Thompson, J. W. and Abernethy, R. B. et al. "Handbook Uncertainty in Gas Turbine Measurements." AEDC-TR-73-5 (AD 755356), February 1973.

TABLE 3. Continued

b. Calculated Parameters

Parameter Designation	Precision Index (S): Percent of Reading	Precision Index (S): Unit of Measurement	Degree of Freedom	Bias (B): Percent of Reading	Bias (B): Unit of Measurement	Uncertainty ±(B + t_{95}S): Percent of Reading	Uncertainty ±(B + t_{95}S): Unit of Measurement	M/RE$\times10^{-6}$	Type of Measuring Device	Type of Recording Device	Method of System Calibration
	STEADY-STATE ESTIMATED MEASUREMENT[a]										
CY		0.0024			0.0007		0.0055	2.25/3.7			
		0.0033			0.0012		0.0078	2.0/3.7			
		0.0026			0.0008		0.0060	2.0/3.5			
		0.0058			0.0017		0.0133	2.0/1.6			
		0.0025			0.0007		0.0057	1.75/3.7			
		0.0024			0.0007		0.0055	1.62/3.7			
		0.0025			0.0007		0.0057	1.5/3.7			
		0.0057			0.0017		0.0134	1.5/1.6			
CLN		0.0006			0.0002		0.0014	4.0/3.7			
		0.0005			0.0002		0.0012	3.75/3.7			
		0.0005			0.0001		0.0011	3.25/3.7			
		0.0005			0.0001		0.0011	3.0/3.7			
		0.0010			0.0003		0.0023	3.0/1.6			
		0.0004			0.0001		0.0009	2.75/3.7			
		0.0004			0.0001		0.0009	2.5/3.7			
		0.0009			0.0002		0.0020	2.5/1.6			
		0.0004			0.0001		0.0009	2.25/3.7			
		0.0004			0.0001		0.0009	2.0/3.7			
		0.0004			0.0001		0.0009	2.0/3.5			
		0.0009			0.0002		0.0020	2.0/1.6			
		0.0004			0.0001		0.0009	1.75/3.7			
		0.0004			0.0001		0.0009	1.62/3.7			
		0.0004			0.0001		0.0009	1.5/3.7			
		0.0009			0.0002		0.0020	1.5/1.6			
CLL		0.00002			0.00004		0.00008	4.0/3.7			
		0.00002			0.00000		0.00004	3.75/3.7			
		0.00002			0.00000		0.00004	3.25/3.7			
		0.00003			0.00000		0.00006	3.0/3.7			
		0.00003			0.00001		0.00007	3.0/1.6			
		0.00001			0.00000		0.00002	2.75/3.7			
		0.00001			0.00000		0.00002	2.5/3.7			
		0.00003			0.00000		0.00006	2.5/1.6			
		0.00001			0.00000		0.00002	2.25/3.7			
		0.00004			0.00000		0.00008	2.0/3.7			
		0.00006			0.00000		0.00012	2.0/3.5			
		0.00004			0.00001		0.00009	2.0/1.6			
		0.00004			0.00000		0.00008	1.75/3.7			
		0.00004			0.00000		0.00008	1.62/3.7			
		0.00003			0.00000		0.00006	1.5/3.7			
		0.00004			0.00001		0.00009	1.5/1.6			

[a] Thompson, J. W. and Abernethy, R. B. et al. "Handbook Uncertainty in Gas Turbine Measurements." AEDC-TR-73-5 (AD 755356), February 1973.

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TABLE 3. Continued

Sverdrup

b. Calculated Parameters

Parameter Designation	STEADY-STATE ESTIMATED MEASUREMENT[a] Precision Index (S) Percent of Reading	Precision Index (S) Unit of Measurement	Degree of Freedom	Bias (B) Percent of Reading	Bias (B) Unit of Measurement	Uncertainty $\pm(B + t_{95}S)$ Percent of Reading	Uncertainty $\pm(B + t_{95}S)$ Unit of Measurement	$M/RE \times 10^{-6}$	Type of Measuring Device	Type of Recording Device	Method of System Calibration
CAT		0.0019			0.0003		0.0041	4.0/3.7			
		0.0020			0.0003		0.0043	3.75/3.7			
		0.0023			0.0004		0.0050	3.25/3.7			
		0.0020			0.0005		0.0045	3.0/3.7			
		0.0031			0.0004		0.0066	3.0/1.6			
		0.0017			0.0004		0.0038	2.75/3.7			
		0.0015			0.0005		0.0035	2.5/3.7			
		0.0026			0.0005		0.0057	2.5/1.6			
		0.0016			0.0005		0.0037	2.25/3.7			
		0.0016			0.0006		0.0038	2.0/3.7			
		0.0019			0.0007		0.0045	2.0/3.5			
		0.0027			0.0006		0.0060	2.0/1.6			
		0.0014			0.0006		0.0034	1.75/3.7			
		0.0013			0.0004		0.0030	1.62/3.7			
		0.0011			0.0007		0.0029	1.5/3.7			
		0.0024			0.0007		0.0055	1.5/1.6			
CA		0.0023			0.0003		0.0049	4.0/3.7			
		0.0025			0.0003		0.0053	3.75/3.7			
		0.0035			0.0004		0.0074	3.25/3.7			
		0.0031			0.0005		0.0067	3.0/3.7			
		0.0038			0.0005		0.0081	3.0/1.6			
		0.0029			0.0005		0.0063	2.75/3.7			
		0.0027			0.0006		0.0060	2.5/3.7			
		0.0035			0.0006		0.0076	2.5/1.6			
		0.0038			0.0007		0.0083	2.25/3.7			
		0.0049			0.0009		0.0107	2.0/3.7			
		0.0052			0.0010		0.0112	2.0/3.5			
		0.0054			0.0009		0.0117	2.0/1.6			
		0.0057			0.0011		0.0125	1.75/3.7			
		0.0075			0.0007		0.0157	1.62/3.7			
		0.0117			0.0014		0.0248	1.5/3.7			
		0.0119			0.0015		0.0253	1.5/1.6			
N.		0.009			0[+]		0.018	4.0/3.7			
		0.010			0[+]		0.020	3.75/3.7			
		0.013			0[+]		0.026	3.25/3.7			
		0.0085			0[+]		0.017	3.0/3.7			
		0.0085			0[+]		0.017	3.0/1.6			
		0.008			0[+]		0.016	2.75/3.7			
		0.006			0[+]		0.012	2.5/3.7			
		0.006			0[+]		0.012	2.5/1.6			

[a] Thompson, J. W. and Abernethy, R. B. et al. "Handbook Uncertainty in Gas Turbine Measurements." AEDC-TR-73-5 (AD 755356), February 1973.
[+] Assumed to be zero

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TABLE 3. Continued

b. Calculated Parameters

Parameter Designation	STEADY-STATE ESTIMATED MEASUREMENT[a]							$\dot{M}/RE \times 10^{-6}$	Type of Measuring Device	Type of Recording Device	Method of System Calibration
	Precision Index (S)			Bias (B)		Uncertainty $\pm(B + t_{95}S)$					
	Percent of Reading	Unit of Measurement	Degree of Freedom	Percent of Reading	Unit of Measurement	Percent of Reading	Unit of Measurement				
M		0.0075			0^*		0.015	2.25/3.7			
		0.008			0^*		0.016	2.0/3.7			
		0.008			0^*		0.016	2.0/3.5			
		0.008			0^*		0.016	2.0/1.6			
		0.0075			0^*		0.015	1.75/3.7			
		0.009			0^*		0.018	1.62/3.7			
		0.0125			0^*		0.025	1.5/3.7			
		0.0125			0^*		0.025	1.5/1.6			
P,psia		0.0037			0.0006		0.0080	4.0/3.7			
		0.0052			0.0008		0.0112	3.75/3.7			
		0.0108			0.0011		0.0227	3.25/3.7			
		0.0092			0.0014		0.0198	3.0/3.7			
		0.0040			0.0006		0.0086	3.0/1.6			
		0.0113			0.0018		0.0244	2.75/3.7			
		0.0111			0.0024		0.0246	2.5/3.7			
		0.0048			0.0011		0.0107	2.5/1.6			
		0.0182			0.0031		0.0395	2.25/3.7			
		0.0232			0.0037		0.0501	2.0/3.7			
		0.0219			0.0036		0.0474	2.0/3.5			
		0.0100			0.0017		0.0217	2.0/1.6			
		0.0283			0.0049		0.0615	1.75/3.7			
		0.0389			0.0034		0.0812	1.62/3.7			
		0.0607			0.0068		0.1282	1.5/3.7			
		0.0261			0.0030		0.0552	1.5/1.6			
Q,psia		0.0260			0.0069		0.0589	4.0/3.7			
		0.0316			0.0075		0.0707	3.75/3.7			
		0.0462			0.0083		0.1007	3.25/3.7			
		0.0321			0.0091		0.0733	3.0/3.7			
		0.0139			0.0039		0.0317	3.0/1.6			
		0.0315			0.0097		0.0727	2.75/3.7			
		0.0236			0.0105		0.0577	2.5/3.7			
		0.0102			0.0046		0.0250	2.5/1.6			
		0.0279			0.0110		0.0668	2.25/3.7			
		0.0232			0.0104		0.0568	2.0/3.7			
		0.0220			0.0100		0.0540	2.0/3.5			
		0.0100			0.0047		0.0247	2.0/1.6			
		0.0150			0.0105		0.0405	1.75/3.7			
		0.0122			0.0063		0.0307	1.62/3.7			
		0.0076			0.0107		0.0259	1.5/3.7			
		0.0034			0.0047		0.0115	1.5/1.6			

[a] Thompson, J. W. and Abernethy, R. B. et al. "Handbook Uncertainty in Gas Turbine Measurements." AEDC-TR-73-5 (AD 755356), February 1973.

*Assumed to be zero

TABLE 3. Concluded

Sverdrup

b. Calculated Parameters

Parameter Designation	Steady-State Estimated Measurement[a]: Precision Index (S): Percent of Reading	Precision Index (S): Unit of Measurement	Degree of Freedom	Bias (B): Percent of Reading	Bias (B): Unit of Measurement	Uncertainty $\pm(B + t_{95}S)$: Percent of Reading	Uncertainty $\pm(B + t_{95}S)$: Unit of Measurement	M/RE$\times10^{-6}$	Type of Measuring Device	Type of Recording Device	Method of System Calibration
RE$\times10^{-6}$, ft^{-1}		0.0220			0.0074		0.0514	4.0/3.7			
		0.0237			0.0074		0.0548	3.75/3.7			
		0.0292			0.0074		0.0658	3.25/3.7			
		0.0218			0.0074		0.0510	3.0/3.7			
		0.0094			0.0033		0.0221	3.0/1.6			
		0.0210			0.0074		0.0494	2.75/3.7			
		0.0179			0.0075		0.0433	2.5/3.7			
		0.0078			0.0033		0.0169	2.5/1.6			
		0.0192			0.0074		0.0458	2.25/3.7			
		0.0192			0.0073		0.0457	2.0/3.7			
		0.0181			0.0071		0.0433	2.0/3.5			
		0.0043			0.0033		0.0196	2.0/1.6			
		0.0170			0.0073		0.0413	1.75/3.7			
		0.0170			0.0004		0.0344	1.62/3.7			
		0.0172			0.0008		0.0352	1.5/3.7			
		0.0074			0.0033		0.0161	1.5/1.6			
ALPHA		0.05			0+		0.10	All			
BETA		0.05			0+		0.10	All			
PBD, psia		0.0015			0+		0.0030	4.0/3.7			
		0.0015			0+		0.0030	3.75/3.7			
		0.0015			0+		0.0030	3.25/3.7			
		0.0015			0+		0.0030	3.0/3.7			
		0.0015			0+		0.0030	3.0/1.6			
		0.0015			0+		0.0030	2.75/3.7			
		0.0015			0+		0.0030	2.5/3.7			
		0.0015			0+		0.0030	2.5/1.6			
		0.0015			0+		0.0030	2.25/3.7			
		0.0015			0+		0.0030	2.0/3.7			
		0.0015			0+		0.0030	2.0/3.5			
		0.0015			0+		0.0030	2.0/1.6			
		0.0016			0+		0.0032	1.75/3.7			
		0.0017			0+		0.0034	1.62/3.7			
		0.0019			0+		0.0038	1.5/3.7			
		0.0016			0+		0.0032	1.5/1.6			

[a] Thompson, J. W. and Abernethy, R. B. et al. "Handbook Uncertainty in Gas Turbine Measurements." AEDC-TR-73-5 (AD 755356), February 1973.
+Assumed to be zero.

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Table 4. Test Summary

M	DATA TYPE POLAR	PHI	ALPHA	TXL	C.R.	RE $\times 10^{-6}$	RUN NUMBERS FOR EACH CONFIG: N00.0 T30C F0 B0	N12.5 T06R F0 B0	N00.0 T30C F4 B0	REMARKS
4.0	ALPHA	0	0^*	47	18.0	3.7		500		
			V^*					501		
			V^+					502		
			V^-					503		
		180	V^-					504		
3.75	ALPHA	0	0^*					505		
			V^+					506		
			V^-					×507		
		180	V^-					×508		
	PHI	V^-	0					×509		
3.25	ALPHA	0	0^*					510		
			V^+					511		
			V^-					×512		
		180	V^-					×513		
	PHI	V^-	0					×514		
3.0	ALPHA	0	0^*				690	515	811	
			V^*					516		
			V^+				691 699	517	812	
			V^-				692 700	518	×813	
		180	V^-				693 701	519	×814	
		0	0^*				Δ590			TDP ~ +24°
			V^+				Δ591			
			V^-				Δ592			
	TXL	0	0	V^*			694		818	
	PHI	V^-	0	47					×815	
		V^+	5						816	
		V^-	-5						817	
	PHI	V^-	0						×835	after hand nulling nozzle
	TXL	0	0	V^*					836	
	PHI	V^-	0	47					×837	after RMAC nulling nozzle
	TXL	0	0	V^*					838	

* Point Pause
\- Continuous Sweep (-) to (+)
\+ Continuous Sweep (+) to (-)
x Runs presented corrected and uncorrected for nonuniformities
Δ Runs presented corrected and uncorrected for humidity

Table 4. Continued

2

M	DATA TYPE POLAR	PHI	ALPHA	TXL	C.R.	RE $\times 10^{-6}$	RUN NUMBERS FOR EACH CONFIG: N00.0 T30C F0 B0	N12.5 T06R F0 B0	N00.0 T80C F4 B0	REMARKS
3.0	PHI	V⁻	0	47	18.0	3.7			×839	no nulling of nozzle
	TXL	0	0	V*					840	
	PHI	V⁻	0	47					×841	after RMAC nulling nozzle
	TXL	0	0	V*					842	
	ALPHA	0	0*	47					827	Jack 35 at Δ= +.050"
			V⁺						828	
			V⁻						829	
		180	V⁻						830	
	TXL	0	0	V*					834	
	PHI	V⁻	0	47					831	
		V⁺	5						832	
		V⁻	-5						833	
	ALPHA	0	0*						819	Jack 27 at Δ= +.050"
			V⁺						820	
			V⁻						821	
		180	V⁻						822	
	TXL	0	0	V*					826	
	PHI	V⁻	0	47					823	
		V⁺	5						824	
		V⁻	-5						825	
	ALPHA	0	0*			1.6		520		
			V⁺					521		
			V⁻					522		
		180	V⁻					523		
2.75		0	0*			3.7	685			
			V⁺				686			
			V⁻				687			
		180	V⁻				688			

* Point Pause
\- Continuous Sweep (-) to (+)
\+ Continuous Sweep (+) to (-)

x Runs presented corrected and uncorrected for nonuniformities
Δ Runs presented corrected and uncorrected for humidity

Table 4. Continued

M	DATA TYPE POLAR	PHI	ALPHA	TXL	C.R.	RE $\times 10^{-6}$	RUN NUMBERS FOR EACH CONFIG: N00.0 T30C F0 B0	N12.5 T06R F0 B0	N00.0 T30C F4 B0	REMARKS
2.75	TXL	0	0	V*	18.0	3.7	689			
2.5	ALPHA	0	0*	47			672	528		
			V*				673			
			V+				674	529		
		↓	V-				x675	530		
		180	V-				x676	531		
		-90	V-				x677			
		90	V-				x678			
	↓	0	V-				679			
	PHI	V-	0				x680			
	↓	V-	10		↓		x681			
	ALPHA	0	V-		0.8		682			
	↓	180	V-	↓	↓		683			
	TXL	0	0	V*	18.0		684			
	ALPHA		V+	42				532		
		↓	V-					533		
		180	V-	↓		↓		534		
		0	0*	47		1.6		524		
			V+					525		
		↓	V-					526		
↓		180	V-			↓		527		
2.25		0	0*			3.7	668	535		
			V+				669	536		
		↓	V-				670	537		
	↓	180	V-	↓				538		
↓	TXL	0	0	V*			671			
2.0	ALPHA	0	0*	47			568	539		
↓	↓	↓	V*	↓	↓	↓		540		

* Point Pause
\- Continuous Sweep (-) to (+)
\+ Continuous Sweep (+) to (-)

x Runs presented corrected and uncorrected for nonuniformities
Δ Runs presented corrected and uncorrected for humidity

Table 4. Continued

4

M	DATA TYPE POLAR	PHI	ALPHA	TXL	C.R.	RE $\times 10^{-6}$	RUN NUMBERS FOR EACH CONFIG: N00.0 T30C F0 B0	N12.5 T06R F0 B0	N00.0 T30C F4 B0	REMARKS
2.0	ALPHA	0	V+	47	18.0	3.7	569	541		
		↓	V-				570 ×608	542		
	↓	180	V-	↓			571	543		
	TXL	0	0	V*			613	544 548		
	ALPHA	-90	V-	47			×609			
	PHI	V-	0				×610			
	↓	V+	10		↓		×611			
	ALPHA	0	V-		0.8	↓	612			
		0	0*		18.0	1.6	635	549		
			V+				636	550		
		↓	V-				637	551		
	↓	180	V-	↓			638	552		
	TXL	0	0	V*			640			
	ALPHA	0	0*	47			Δ587			TDP ~ +24°
			V+				Δ588			
		↓	V-			↓	Δ589			↓
		0	0*			3.7	Δ572		Δ762	TDP ~ -6°
			V+				Δ573		Δ763	
	↓	↓	V-				Δ574			
	PHI	V-	0	↓					Δ764	
	TXL	0	0	V*					Δ765	↓
	ALPHA	0	V+	47					Δ766	TDP ~ 0°
	PHI	V-	0	↓					Δ767	
	TXL	0	0	V*					Δ768	↓
↓	ALPHA	0	0*	47	↓	↓	Δ575			TDP ~+3°

* Point Pause
\- Continuous Sweep (-) to (+)
\+ Continuous Sweep (+) to (-)

x Runs presented corrected and uncorrected for nonuniformities
Δ Runs presented corrected and uncorrected for humidity

Table 4. Continued

M	DATA TYPE POLAR	PHI	ALPHA	TXL	C.R.	RE $\times 10^{-6}$	RUN NUMBERS FOR EACH CONFIG: N00.0 T30C F0 B0	N12.5 T06R F0 B0	N00.0 T30C F4 B0	REMARKS
2.0	ALPHA	0	V+	47	18.0	3.7	Δ576		Δ769	TDP ~ +3°
			V−				Δ577			
	PHI	V−	0						Δ770	
	TXL	0	0	V*					Δ771	
	ALPHA	0	0*	47			Δ578			TDP ~ +10°
			V+				Δ579			
			V−				Δ580			
			0*				Δ581			TDP ~ +16°
			V+				Δ582		Δ772	
			V−				Δ583			
	PHI	V−	0						Δ773	
	TXL	0	0	V*					Δ774	
	ALPHA	0	0*	47			Δ584			TDP ~ +24°
			V+				Δ585		Δ775	
			V−				Δ586			
			0*			3.5			746	
			V+						747	
			V−				616		×748 776	
		180	V−				617		×749 793	
	PHI	V−	0				614		×794, ×777, ×750, ×807, ×808	
		V+	10				615			
		V+	5						751	
		V−	−5						752	
	TXL	0	0	V*			626, 633, 629		753, 809, 778, 810	
	ALPHA	0	V−	42			620		×754	
		180	V−				621			
	PHI	V−	0				618		×755	
		V+	10				619			
		V+	5						756	
		V−	−5						757	

* Point Pause
− Continuous Sweep (−) to (+)
\+ Continuous Sweep (+) to (−)
× Runs presented corrected and uncorrected for nonuniformities
Δ Runs presented corrected and uncorrected for humidity

Table 4. Continued

6

M	DATA TYPE POLAR	PHI	ALPHA	TXL	C.R.	RE $\times 10^{-6}$	RUN NUMBERS FOR EACH CONFIG: N00.0 T30C F0 B0	N12.5 T06R F0 B0	N00.0 T30C F4 B0	REMARKS
2.0	ALPHA	0	V^-	38	18.0	3.5			×758	
	PHI	V^-	0						×759	
		V^+	5						760	
		V^-	-5						761	
	ALPHA	0	V^-	37			×624			
		180	V^-				×625			
	PHI	V^-	0				×622			
		V^+	10				×623			
	ALPHA	0	V^-	47			628			Jack 31 at Δ=+.050"
	TXL	0	0	V^*			627	545		
	TXL	0	0	47			632			Jack 31 at Δ=+.075"
	ALPHA	0	0^*						779	Jack 36 at Δ=+.050"
			V^+						780	
			V^-				631		781	
		180	V^-						782	
	PHI	V^-	0						783 792	
		V^+	5						784	
		V^-	-5						785	
	TXL	0	0	V^*			630	546	786	
	TXL	0	0	47			634			Jack 36 at Δ=+.075"
	ALPHA	0	V^-	42					787	Jack 36 at Δ=+.050"
	PHI	V^-	0						788	
		V^+	5						789	
		V^-	-5						790	
	ALPHA	0	0^*	47					795	Jack 38 at Δ=+.050"
			V^+						796	
			V^-						797	
		180	V^-						798	
	PHI	V^-	0						799	
		V^+	5						800	
		V^-	-5						801	

* Point Pause
\- Continuous Sweep (-) to (+)
\+ Continuous Sweep (+) to (-)

x Runs presented corrected and uncorrected for nonuniformities
Δ Runs presented corrected and uncorrected for humidity

Table 4. Continued

7

M	DATA TYPE POLAR	PHI	ALPHA	TXL	C.R.	RE $\times 10^{-6}$	RUN NUMBERS FOR EACH CONFIG: N00.0 T30C F0 B0	N12.5 T0GR F0 B0	N00.0 T30C F4 B0	REMARKS
2.0	TXL	0	0	V*	18.0	3.5			802	Jack 38 at Δ=+.050"
	ALPHA	0	V-	38					803	
	PHI	V-	0						804	
		V+	5						805	
		V-	-5						806	
	ALPHA	0	0*	47					702	TAPE = .005"
			V+						703	
			V*						704	
			V-						705	
		180	V-						706	
	PHI	V-	0						707	
		V+	5						711	
		V+	10						708	
		V-	-10						709	
	TXL	0	0	V*					710	
		0	0						728	TAPE = .010", F2 not F4
		90	0						729	
	ALPHA	0	0*	47					730	
			V+						731	
			V-						732	
		180	V-						733	
	PHI	V-	0						734	
		V+	5						735	
		V-	-5						736	
	TXL	0	0	V*					737	
	ALPHA	0	V-	42					738	
	PHI	V-	0						739	
		V+	5						740	
		V-	-5						741	

* Point Pause
\- Continuous Sweep (-) to (+)
\+ Continuous Sweep (+) to (-)
x Runs presented corrected and uncorrected for nonuniformities
Δ Runs presented corrected and uncorrected for humidity

Table 4. Continued

8

M	DATA TYPE POLAR	PHI	ALPHA	TXL	C.R.	RE $\times 10^{-6}$	RUN NUMBERS FOR EACH CONFIG: N00.0 T30C F0 B0	N12.5 T06R F0 B0	N00.0 T30C F4 B0	REMARKS
2.0	ALPHA	0	V-	38	18.0	3.5			742	TAPE = .010"
	PHI	V-	0						743	
		V+	5						744	
↓	↓	V-	-5	↓		↓			745	↓
1.75	ALPHA	0	0*	47		3.7	664	555		
			V+				665	556		
		↓	V-				666	557		
	↓	180	V-	↓				558		
↓	TXL	0	0	V*			667			
1.62	ALPHA	0	0*	47			660			
			V+				661			
	↓	↓	V-	↓			662			
↓	TXL	0	0	V*			663			
1.5	ALPHA	0	0*	47			647	559		
			V*				648			
			V+				649	560		
		↓	V-				x650	561		
		180	V-				x651	562		
		-90	V-				x652			
		+90	V-				x653			
	↓	0	V-				654			
	PHI	V-	0				x655			
	↓	V+	10		↓		x656			
	ALPHA	0	V-		0.8		657			
	↓	180	V-	↓	0.8		658			
	TXL	0	0	V*	18.0		659			
	ALPHA	0	0*	47			Δ593			TDP ~ +24°
↓	↓	0	V+	47	↓	↓	Δ594			↓

* Point Pause
\- Continuous Sweep (-) to (+)
\+ Continuous Sweep (+) to (-)

x Runs presented corrected and uncorrected for nonuniformities
Δ Runs presented corrected and uncorrected for humidity

9

Table 4 Concluded

M	DATA TYPE POLAR	PHI	ALPHA	TXL	C.R.	RE $\times 10^{-6}$	RUN NUMBERS FOR EACH CONFIG: N00.0 T30C F0 B0	N12.5 T06R F0 B0	N00.0 T30C F4 B0	REMARKS
1.5	ALPHA	0	V⁻	47	18.0	3.7	Δ595			TDP ~ +24°
			0*			1.6	641	563		
			V*				642			
			V⁺				643	564		
			V⁻				644	565		
		180	V⁻				645	566		
	TXL	0	0	V*			646			

* Point Pause
\- Continuous Sweep (-) to (+)
\+ Continuous Sweep (+) to (-)

x Runs presented corrected and uncorrected for nonuniformities
Δ Runs presented corrected and uncorrected for humidity

APPENDIX III

SAMPLE TABULATED DATA

ARO, INC. - AEDC DIVISION
A SVERDRUP CORPORATION COMPANY
VON KARMAN GAS DYNAMICS FACILITY
ARNOLD AIR FORCE STATION, TENNESSEE
STANDARD FORCE CONE (5 DEG)
PAGE 1

DATE COMPUTED 31-AUG-79
TIME COMPUTED 11:04:53
DATE RECORDED 30-APR-79
TIME RECORDED 20:25:31
PROJECT NUMBER V41A-07

RUN	CODE	M	PT	TT	Q	P	T	RE	A	REF LENGTHS(CLM,CLN,CLL)		
502	4	4.02	46.98	599.7	3.408	0.301	141.7	0.367E+07	28.274	34.290	34.290	34.290

CONFIG
N12.5-T06R-F0-B0

BODY AXIS-XMRP = (2/3) LM

PN	ALPHA	BETA	PHI	CN	CLM	CY	CLN	CLL	CAT	CAB	CA	NCP/LM	YCP/LM	A.C.	TXL
1	11.60	0.01	0.02	0.5261	-0.0081	-0.0038	0.0003	0.0000	0.1478	0.0794	0.0685	0.6821	0.6956	0.6817	46.6385
2	11.00	0.00	0.01	0.4863	-0.0075	-0.0037	0.0003	0.0000	0.1457	0.0794	0.0664	0.6822	0.7033	0.6819	46.6364
3	10.00	0.00	0.02	0.4256	-0.0066	-0.0033	0.0003	0.0000	0.1431	0.0791	0.0640	[illegible]	0.6997	0.6823	46.6358
4	9.00	0.00	0.00	0.3667	-0.0056	-0.0028	0.0003	0.0000	0.1410	0.0785	0.0625	[illegible]	0.7020	0.6826	46.6364
5	8.00	-0.00	0.00	0.3122	-0.0048	-0.0030	0.0003	0.0000	0.1394	0.0781	0.0613	[illegible]	0.7068	0.6823	46.6385
6	7.00	0.00	0.02	0.2629	-0.0040	-0.0024	0.0003	0.0000	0.1387	0.0777	0.0609	0.6820	0.6989	0.6815	46.6354
7	6.00	0.00	0.01	0.2160	-0.0033	-0.0020	0.0002	0.0000	0.1378	0.0774	0.0604	0.6822	0.7038	0.6810	46.6344
8	5.00	0.00	0.02	0.1751	-0.0027	-0.0018	0.0003	0.0000	0.1367	0.0765	0.0602	0.6826	0.7269	0.6807	46.6330
9	4.00	-0.00	0.00	0.1365	-0.0022	-0.0016	0.0003	0.0000	0.1352	0.0756	0.0596	0.6833	0.7293	0.6810	46.6331
10	3.00	0.00	0.02	0.1004	-0.0017	-0.0015	0.0003	0.0000	0.1336	0.0748	0.0589	0.6839	0.7309	0.6815	46.6320
11	2.00	-0.00	0.01	0.0659	-0.0011	-0.0010	0.0002	0.0000	0.1321	0.0740	0.0581	0.6848	0.7337	0.6829	46.6325
12	1.50	-0.00	0.01	0.0496	-0.0009	-0.0013	0.0002	0.0000	0.1318	0.0735	0.0583	0.6860	0.7177	0.6843	46.6355
13	1.00	-0.00	0.01	0.0336	-0.0006	-0.0010	0.0002	0.0000	0.1316	0.0733	0.0583	0.6857	0.7144	0.6855	46.6324
14	0.75	-0.00	0.02	0.0261	-0.0004	-0.0011	0.0002	0.0000	0.1314	0.0731	0.0583	0.6857	0.7138	0.6849	46.6315
15	0.50	-0.00	0.02	0.0176	-0.0003	-0.0012	0.0002	0.0000	0.1314	0.0731	0.0584	0.6864	0.7006	0.6855	46.6316
16	0.25	-0.00	0.01	0.0091	-0.0002	-0.0013	0.0002	0.0000	0.1315	0.0731	0.0584	0.6887	0.7157	0.6857	46.6332
17	0.00	-0.00	0.00	0.0020	0.0000	-0.0010	0.0002	0.0000	0.1316	0.0732	0.0584	0.6817	0.7146	0.6862	46.6326
18	-0.25	-0.00	0.01	-0.0053	0.0001	-0.0009	0.0002	0.0000	0.1315	0.0734	0.0582	0.6842	0.7179	0.6876	46.6318
19	-0.50	-0.00	-0.00	-0.0125	0.0003	-0.0009	0.0002	0.0000	0.1315	0.0734	0.0580	0.6856	0.7171	0.6879	46.6337
20	-0.75	-0.00	0.01	-0.0213	0.0005	-0.0008	0.0002	0.0000	0.1316	0.0734	0.0582	0.6879	0.7116	0.6872	46.6335
21	-1.00	-0.00	0.00	-0.0299	0.0007	-0.0010	0.0002	0.0000	0.1318	0.0732	0.0586	0.6879	0.7132	0.6856	46.6327
22	-1.50	-0.00	0.01	-0.0451	0.0009	-0.0008	0.0002	0.0000	0.1319	0.0733	0.0586	0.6852	0.6729	0.6830	46.6343
23	-2.00	-0.00	0.00	-0.0623	0.0012	-0.0005	0.0002	0.0000	0.1324	0.0739	0.0585	0.6852	0.7400	0.6820	46.6323
24	-3.00	-0.00	0.00	-0.0965	0.0017	-0.0005	0.0002	0.0000	0.1338	0.0747	0.0591	0.6836	0.7085	0.6806	46.6329
25	-4.00	-0.00	0.00	-0.1323	0.0022	-0.0006	0.0002	0.0000	0.1352	0.0756	0.0596	0.6826	0.6895	0.6794	46.6351
26	-5.00	-0.00	0.00	-0.1701	0.0026	-0.0005	0.0002	0.0000	0.1365	0.0765	0.0601	0.6816	0.6881	0.6790	46.6316
27	-6.00	-0.00	-0.00	-0.2114	0.0031	-0.0004	0.0002	0.0000	0.1376	0.0773	0.0603	0.6812	0.7051	0.6788	46.6320
28	-7.00	-0.00	0.00	-0.2554	0.0037	-0.0003	0.0002	0.0000	0.1383	0.0777	0.0606	0.6808	0.7154	0.6789	46.6331
29	-8.00	-0.00	0.01	-0.3052	0.0042	-0.0008	0.0002	0.0000	0.1391	0.0781	0.0610	0.6804	0.6551	0.6793	46.6328
30	-9.00	-0.00	0.02	-0.3592	0.0049	-0.0000	0.0002	0.0000	0.1402	0.0784	0.0618	0.6802	0.8130	0.6798	46.6311
31	-10.00	-0.00	0.00	-0.4171	0.0057	-0.0002	0.0002	0.0000	0.1424	0.0790	0.0634	0.6803	0.6195	0.6805	46.6317
32	-11.00	-0.00	-0.00	-0.4788	0.0066	0.0000	0.0002	0.0000	0.1449	0.0795	0.0654	0.6803	1.3129	0.6808	46.6303
33	-11.21	-0.00	-0.00	-0.4911	0.0068	0.0001	0.0002	0.0000	0.1455	0.0795	0.0660	0.6803	0.4501	0.6809	46.6338

Sample Tabulated Data: Body Axis Data

ARO, INC. - AEDC DIVISION
A SVERDRUP CORPORATION COMPANY
VON KARMAN GAS DYNAMICS FACILITY
ARNOLD AIR FORCE STATION, TENNESSEE
STANDARD FORCE CONE (5 DEG)
PAGE 2

DATE COMPUTED 31-AUG-79
TIME COMPUTED 11:04:53
DATE RECORDED 30-APR-79
TIME RECORDED 20:25:31
PROJECT NUMBER V41A-07

RUN	CODE	M	PT	TT	Q	P	T	RE	A	REF LENGTHS(CLM,CLN,CLL)		
502	4	4.02	46.98	599.7	3.408	0.301	141.7	0.367E+07	28.274	34.290	34.290	34.290

CONFIG
N12.5-T06R-F0-80

BODY AXIS-XMRP = (1/2) LM

PN	ALPHA	BETA	PHI	CN	CLM	CY	CLN	CLL	CAT	CAB	CA	XCP/LM	YCP/LM	A.C.	TXL
1	11.60	0.01	0.02	0.5261	-0.0958	-0.0038	0.0009	0.0000	0.1478	0.0794	0.0685	0.6821	0.6956	0.6817	46.6385
2	11.00	0.00	0.01	0.4863	-0.0886	-0.0037	0.0009	0.0000	0.1457	0.0794	0.0664	0.6822	0.7033	0.6819	46.6364
3	10.00	0.00	0.02	0.4256	-0.0775	-0.0033	0.0008	0.0000	0.1431	0.0791	0.0640	0.6823	0.6997	0.6823	46.6358
4	9.00	0.00	0.00	0.3667	-0.0667	-0.0029	0.0007	0.0000	0.1410	0.0785	0.0625	0.6820	0.7020	0.6826	46.6364
5	8.00	-0.00	0.00	0.3122	-0.0568	-0.0030	0.0008	0.0000	0.1394	0.0781	0.0613	0.6820	0.7068	0.6823	46.6385
6	7.00	0.00	0.02	0.2629	-0.0478	-0.0024	0.0007	0.0000	0.1387	0.0777	0.0609	0.6820	0.6989	0.6815	46.6354
7	6.00	0.00	0.01	0.2160	-0.0393	-0.0020	0.0006	0.0000	0.1378	0.0774	0.0604	0.6622	0.7038	0.6810	46.6366
8	5.00	0.00	0.02	0.1751	-0.0319	-0.0018	0.0006	0.0000	0.1367	0.0765	0.0602	0.6826	0.7269	0.6807	46.6330
9	4.00	-0.00	0.00	0.1365	-0.0250	-0.0016	0.0005	0.0000	0.1352	0.0756	0.0596	0.6833	0.7293	0.6810	46.6331
10	3.00	0.00	0.02	0.1004	-0.0184	-0.0015	0.0005	0.0000	0.1336	0.0748	0.0589	0.6839	0.7309	0.6815	46.6320
11	2.00	-0.00	0.01	0.0659	-0.0121	-0.0010	0.0004	0.0000	0.1321	0.0740	0.0581	0.6848	0.7337	0.6829	46.6325
12	1.50	-0.00	0.01	0.0496	-0.0092	-0.0013	0.0004	0.0000	0.1318	0.0735	0.0583	0.6860	0.7177	0.6643	46.6355
13	1.00	-0.00	0.01	0.0336	-0.0062	-0.0010	0.0004	0.0000	0.1316	0.0733	0.0583	0.6857	0.7144	0.6855	46.6324
14	0.75	-0.00	0.02	0.0261	-0.0048	-0.0011	0.0004	0.0000	0.1314	0.0731	0.0583	0.6857	0.7138	0.6849	46.6315
15	0.50	-0.00	0.02	0.0176	-0.0032	-0.0012	0.0004	0.0000	0.1314	0.0731	0.0584	0.6864	0.7006	0.6855	46.6316
16	0.25	-0.00	0.01	0.0091	-0.0017	-0.0013	0.0004	0.0000	0.1315	0.0731	0.0584	0.6887	0.7157	0.6857	46.6332
17	0.00	-0.00	0.00	0.0020	-0.0003	-0.0010	0.0004	0.0000	0.1316	0.0732	0.0584	0.6817	0.7146	0.6862	46.6326
18	-0.25	-0.00	0.01	-0.0053	0.0010	-0.0009	0.0004	0.0000	0.1315	0.0734	0.0582	0.6842	0.7179	0.6876	46.6318
19	-0.50	-0.00	-0.00	-0.0125	0.0024	-0.0009	0.0004	0.0000	0.1315	0.0734	0.0580	0.6856	0.7171	0.6879	46.6337
20	-0.75	-0.00	0.01	-0.0213	0.0041	-0.0008	0.0003	0.0000	0.1316	0.0734	0.0582	0.6879	0.7116	0.6872	46.6335
21	-1.00	-0.00	0.00	-0.0289	0.0055	-0.0010	0.0004	0.0000	0.1318	0.0732	0.0586	0.6879	0.7132	0.6856	46.6327
22	-1.50	-0.00	0.01	-0.0451	0.0084	-0.0008	0.0003	0.0000	0.1319	0.0733	0.0586	0.6652	0.6729	0.6830	46.6343
23	-2.00	-0.00	0.00	-0.0623	0.0116	-0.0005	0.0003	0.0000	0.1324	0.0739	0.0585	0.6852	0.7400	0.6820	46.6323
24	-3.00	-0.00	0.00	-0.0965	0.0178	-0.0005	0.0003	0.0000	0.1338	0.0747	0.0591	0.6836	0.7085	0.6906	46.6329
25	-4.00	-0.00	0.00	-0.1323	0.0242	-0.0006	0.0003	0.0000	0.1352	0.0756	0.0596	0.6826	0.6895	0.6794	46.6351
26	-5.00	-0.00	0.00	-0.1701	0.0309	-0.0005	0.0003	0.0000	0.1365	0.0765	0.0601	0.6816	0.6681	0.6790	46.6316
27	-6.00	-0.00	-0.00	-0.2114	0.0383	-0.0004	0.0002	0.0000	0.1376	0.0773	0.0603	0.6812	0.7051	0.6788	46.6328
28	-7.00	-0.00	0.00	-0.2554	0.0462	-0.0003	0.0002	0.0000	0.1383	0.0777	0.0606	0.6808	0.7154	0.6789	46.6331
29	-8.00	-0.00	0.01	-0.3052	0.0551	-0.0008	0.0003	0.0000	0.1391	0.0781	0.0610	0.6804	0.6551	0.6793	46.6328
30	-9.00	-0.00	0.02	-0.3592	0.0648	-0.0000	0.0002	0.0000	0.1402	0.0784	0.0618	0.6802	0.8130	0.6798	46.6311
31	-10.00	-0.00	0.00	-0.4171	0.0753	-0.0002	0.0002	0.0000	0.1424	0.0790	0.0634	0.6803	0.6195	0.6805	46.6317
32	-11.00	-0.00	-0.00	-0.4788	0.0864	0.0000	0.0002	0.0000	0.1449	0.0795	0.0654	0.6803	1.3129	0.6809	46.6303
33	-11.21	-0.00	-0.00	-0.4911	0.0886	0.0001	0.0002	0.0000	0.1455	0.0795	0.0660	0.6803	0.4501	0.6809	46.6338

Sample Tabulated Data: Body Axis Data

ARO, INC. - AEDC DIVISION
A SVERDRUP CORPORATION COMPANY
VON KARMAN GAS DYNAMICS FACILITY
ARNOLD AIR FORCE STATION, TENNESSEE
STANDARD FORCE CONE (5 DEG)
PAGE 3

DATE COMPUTED 31-AUG-79
TIME COMPUTED 11:04:54
DATE RECORDED 30-APR-79
TIME RECORDED 20:25:31
PROJECT NUMBER V41A-07

RUN	CODE	M	PT	TT	Q	P	T	RE	A	REF LENGTHS(CLM,CLN,CLL)		
502	4	4.02	46.98	599.7	3.408	0.301	141.7	0.367E+07	28.274	34.290	34.290	34.290

CONFIG
M12.5-T06R-F0-B0

MISSILE AXIS-XMRP = (2/3) LM

PN	ALPHA	BETA	PHI	ALPP	CNP	CLMP	CYP	CLNP	CLLP	CAP	NCPP/LM	YCPP/LM	A.C.P	TXL
1	11.60	0.01	0.02	11.60	0.5261	-0.0081	-0.0036	0.0003	0.0000	0.1478	0.6821	0.6965	0.6817	46.6385
2	11.00	0.00	0.01	11.00	0.4863	-0.0075	-0.0036	0.0003	0.0000	0.1457	0.6822	0.7039	0.6819	46.6364
3	10.00	0.00	0.02	10.00	0.4256	-0.0066	-0.0032	0.0003	0.0000	0.1431	0.6823	0.7003	0.6823	46.6358
4	9.00	0.00	0.00	9.00	0.3667	-0.0056	-0.0028	0.0003	0.0000	0.1410	0.6820	0.7021	0.6826	46.6364
5	8.00	-0.00	0.00	8.00	0.3122	-0.0048	-0.0030	0.0003	0.0000	0.1394	0.6820	0.7068	0.6823	46.6385
6	7.00	0.00	0.02	7.00	0.2629	-0.0040	-0.0023	0.0002	0.0000	0.1387	0.6820	0.6996	0.6815	46.6354
7	6.00	0.00	0.01	6.00	0.2160	-0.0033	-0.0019	0.0002	0.0000	0.1378	0.6822	0.7044	0.6810	46.6344
8	5.00	0.00	0.02	5.00	0.1751	-0.0027	-0.0018	0.0003	0.0000	0.1367	0.6826	0.7280	0.6807	46.6330
9	4.00	-0.00	0.00	4.00	0.1365	-0.0022	-0.0016	0.0003	0.0000	0.1352	0.6833	0.7296	0.6810	46.6331
10	3.00	0.00	0.02	3.00	0.1004	-0.0017	-0.0015	0.0003	0.0000	0.1336	0.6839	0.7320	0.6815	46.6320
11	2.00	-0.00	0.01	2.00	0.0659	-0.0011	-0.0010	0.0002	0.0000	0.1321	0.6848	0.7344	0.6829	46.6325
12	1.50	-0.00	0.01	1.50	0.0496	-0.0009	-0.0012	0.0002	0.0000	0.1318	0.6860	0.7178	0.6843	46.6355
13	1.00	-0.00	0.01	1.00	0.0336	-0.0006	-0.0009	0.0002	0.0000	0.1316	0.6857	0.7146	0.6855	46.6324
14	0.75	-0.00	0.02	0.75	0.0261	-0.0004	-0.0011	0.0002	0.0000	0.1314	0.6857	0.7140	0.6849	46.6315
15	0.50	-0.00	0.02	0.50	0.0176	-0.0003	-0.0012	0.0002	0.0000	0.1314	0.6864	0.7007	0.6855	46.6316
16	0.25	-0.00	0.01	0.25	0.0091	-0.0002	-0.0013	0.0002	0.0000	0.1315	0.6887	0.7157	0.6857	46.6332
17	0.00	-0.00	0.00	-0.00	0.0020	0.0000	-0.0010	0.0002	0.0000	0.1316	0.6817	0.7146	0.6862	46.6326
18	-0.25	-0.00	0.01	-0.25	-0.0053	0.0001	-0.0009	0.0002	0.0000	0.1315	0.6842	0.7178	0.6876	46.6318
19	-0.50	-0.00	-0.00	-0.50	-0.0125	0.0003	-0.0009	0.0002	0.0000	0.1315	0.6856	0.7171	0.6879	46.6337
20	-0.75	-0.00	0.01	-0.75	-0.0213	0.0005	-0.0008	0.0002	0.0000	0.1316	0.6879	0.7115	0.6872	46.6335
21	-1.00	-0.00	0.00	-1.00	-0.0289	0.0007	-0.0010	0.0002	0.0000	0.1318	0.6879	0.7132	0.6856	46.6327
22	-1.50	-0.00	0.01	-1.50	-0.0451	0.0009	-0.0009	0.0002	0.0000	0.1319	0.6852	0.6730	0.6830	46.6343
23	-2.00	-0.00	0.00	-2.00	-0.0623	0.0012	-0.0005	0.0002	0.0000	0.1324	0.6852	0.7395	0.6820	46.6323
24	-3.00	-0.00	0.00	-3.00	-0.0965	0.0017	-0.0005	0.0002	0.0000	0.1338	0.6836	0.7082	0.6806	46.6329
25	-4.00	-0.00	0.00	-4.00	-0.1323	0.0022	-0.0006	0.0002	0.0000	0.1352	0.6826	0.6894	0.6794	46.6351
26	-5.00	-0.00	0.00	-5.00	-0.1701	0.0026	-0.0005	0.0002	0.0000	0.1365	0.6816	0.6981	0.6790	46.6316
27	-6.00	-0.00	-0.00	-6.00	-0.2114	0.0031	-0.0004	0.0002	0.0000	0.1376	0.6812	0.7056	0.6788	46.6328
28	-7.00	-0.00	0.00	-7.00	-0.2554	0.0037	-0.0003	0.0002	0.0000	0.1383	0.6808	0.7134	0.6789	46.6331
29	-8.00	-0.00	0.01	-8.00	-0.3052	0.0042	-0.0009	0.0002	0.0000	0.1391	0.6804	0.6572	0.6793	46.6328
30	-9.00	-0.00	0.02	-9.00	-0.3592	0.0049	-0.0001	0.0002	0.0000	0.1402	0.6802	0.7237	0.6798	46.6311
31	-10.00	-0.00	0.00	-10.00	-0.4171	0.0057	-0.0002	0.0002	0.0000	0.1424	0.6803	0.6282	0.6805	46.6317
32	-11.00	-0.00	-0.00	-11.00	-0.4788	0.0066	0.0000	0.0002	0.0000	0.1449	0.6803	1.2655	0.6808	46.6303
33	-11.21	-0.00	-0.00	-11.21	-0.4911	0.0068	0.0002	0.0002	0.0000	0.1455	0.6803	0.4844	0.6809	46.6338

Sample Tabulated Data: Missile Axis Data

ARO, INC. - AEDC DIVISION
A SVERDRUP CORPORATION COMPANY
VON KARMAN GAS DYNAMICS FACILITY
ARNOLD AIR FORCE STATION, TENNESSEE
STANDARD FORCE CONE (5 DEG)
PAGE 4

DATE COMPUTED 31-AUG-79
TIME COMPUTED 11:04:52
DATE RECORDED 30-APR-79
TIME RECORDED 20:25:31
PROJECT NUMBER V41A-07

RUN	CODE	M	PT	TT	Q	P	T	RE	A	REF LENGTHS(CLM,CLN,CLL)		
502	4	4.02	46.98	599.7	3.408	0.301	141.7	0.367E+07	28.274	34.290	34.290	34.290

CONFIG
N12.5-T06R-F0-R0

PN	ALPI	PHII	PT	TT	Q	P	CAR	PBA/P	PB1/P	PB2/P	PB3/P	PB4/P	PBD/P
1	11.08	0.02	46.98	599.7	3.408	0.301	0.0794	0.1022					0.1022
2	10.51	0.01	46.98	599.7	3.408	0.301	0.0794	0.1020					0.1020
3	9.54	0.01	46.91	599.7	3.403	0.301	0.0791	0.1054					0.1054
4	8.57	0.00	47.01	599.7	3.411	0.302	0.0785	0.1119					0.1119
5	7.61	0.00	46.95	599.7	3.406	0.301	0.0781	0.1163					0.1163
6	6.63	0.07	46.99	599.7	3.409	0.301	0.0777	0.1205					0.1205
7	5.66	0.01	46.95	599.7	3.406	0.301	0.0774	0.1246					0.1246
8	4.68	0.01	46.95	599.7	3.406	0.301	0.0765	0.1343					0.1343
9	3.70	0.00	47.01	599.7	3.410	0.301	0.0756	0.1445					0.1445
10	2.73	0.02	46.94	599.7	3.406	0.301	0.0748	0.1544					0.1544
11	1.74	0.01	46.97	599.7	3.408	0.301	0.0740	0.1634					0.1634
12	1.25	0.00	46.92	599.7	3.404	0.301	0.0735	0.1682					0.1682
13	0.76	0.01	46.99	599.7	3.409	0.301	0.0733	0.1713					0.1713
14	0.52	0.02	46.99	599.7	3.409	0.301	0.0731	0.1729					0.1729
15	0.27	0.02	46.95	599.7	3.406	0.301	0.0731	0.1736					0.1736
16	0.03	0.01	46.92	599.7	3.404	0.301	0.0731	0.1732					0.1732
17	-0.22	0.00	46.87	599.7	3.400	0.301	0.0732	0.1719					0.1719
18	-0.47	0.01	46.97	599.7	3.407	0.301	0.0734	0.1700					0.1700
19	-0.71	-0.00	47.01	599.7	3.410	0.301	0.0734	0.1695					0.1695
20	-0.96	0.01	46.94	599.7	3.406	0.301	0.0734	0.1702					0.1702
21	-1.21	0.00	46.98	599.7	3.408	0.301	0.0732	0.1721					0.1721
22	-1.70	0.00	46.96	599.7	3.407	0.301	0.0733	0.1707					0.1707
23	-2.19	0.00	46.91	599.7	3.403	0.301	0.0739	0.1642					0.1642
24	-3.17	0.00	46.98	599.7	3.408	0.301	0.0747	0.1554					0.1554
25	-4.15	0.00	47.02	599.7	3.411	0.302	0.0756	0.1452					0.1452
26	-5.13	0.00	46.91	599.7	3.403	0.301	0.0765	0.1349					0.1349
27	-6.10	-0.00	47.00	599.7	3.410	0.301	0.0773	0.1259					0.1259
28	-7.08	0.00	47.00	599.7	3.409	0.301	0.0777	0.1206					0.1206
29	-8.05	0.01	47.01	599.7	3.410	0.301	0.0781	0.1168					0.1168
30	-9.02	0.02	46.99	599.7	3.409	0.301	0.0784	0.1131					0.1131
31	-9.99	0.00	46.98	599.7	3.408	0.301	0.0790	0.1065					0.1065
32	-10.95	-0.00	46.95	599.7	3.406	0.301	0.0795	0.1007					0.1007
33	-11.16	-0.00	46.92	599.7	3.404	0.301	0.0795	0.1005					0.1005

TDPC= -11.0 TDPD= -7.0

Sample Tabulated Data: Tunnel Contitions Data